

IMPORTANT NOTICE: A printed copy of this document may not be the version currently in effect. The current official version is available via the Sandia National Laboratories Nuclear Waste Management Online Documents web site.

Effective Date 4-18-95

TITLE: INSTALLATION OR REMOVAL OF FLUKE HYDRA DATA BUCKETS, THERMOCOUPLES, AND PRESSURE TRANSDUCERS USED IN THE PERMEABILITY TEST EQUIPMENT

Prepared by: William E. Horvath Date: 3-16-95
SNL Reviewer: Ron Pearson ³⁻²³⁻⁹⁵ Date: 3-16-95
SNL Approval: Steve Myer Date: 3-21-95
SNL Safety Approval: CJ McKinstry Date: 3-17-95
MOC Cognizant Department Manager Concurrence: TWS [Signature] Date: 5-27-95
MOC Manager of Industrial Safety: [Signature] [Signature] Date: 3-28-95
SNL QA Approval: James Trone Date: 3-31-95
[Signature] 3/15/95

PURPOSE: The purpose of this procedure is to establish a method for installing or replacing, validating the proper function of, and providing QA documentation for Fluke Hydra Data Buckets, thermocouples, and pressure transducers used in the permeability test equipment.

RESPONSIBILITY: It is the responsibility of all personnel installing, removing, or troubleshooting pressure transducers to be familiar with this procedure and have former training and qualifications for permeability test equipment.

SAFETY: The low excitation voltages (10 - 15 VDC) for pressure transducers limit the safety concerns to those of pressurized gas and/or liquid. Work will be done in accordance with the SNL Pressure Safety Manual, MN471000. MSDSs for all chemicals will be reviewed prior to use.

REFERENCES: (latest revision)

- I. SNL Pressure Safety Manual, MN471000
- II. SNL WIPP Engineering Sketches for equipment Process and Instrumentation Diagram (P&ID)
- III. SNL WIPP Engineering Sketches for Fluke/Transducer Cable Schematic

- IV. SNL WIPP Procedure 438, Instrumentation System Verification During Gage Connection to Stand Alone Data Acquisition Systems
- V. SNL WIPP Procedure 447, System Configuration and Operation For the Digital Gas Flow Tool (DGFT)
- VI. SNL WIPP Procedure 485, Operation of the Fluke Hydra Data Acquisition System, with and without a PC Interface
- VII. SNL WIPP Procedure 487, Operation of the Digital Brine Control Panels (DBCP) For Brine Testing of Sealing Structures and Surrounding Disturbed Rock Zone (DRZ)
- VIII. Tool Maintenance Log (DGFT, DBCP, etc.)

FORMS: (latest revision)

- I. Form 34, General Purpose Data Form
- II. Form 270, Digital Permeability Tool Calibration and Installation

QA RECORDS:

- I. Form 34, General Purpose Data Form
- II. Form 270, Digital Permeability Tool Calibration and Installation

PROCEDURE:

When fluid flow test systems are built, it is necessary to install transducers and data collection equipment. Each of these pieces of equipment will have a calibration expiration date. Replace these pieces of equipment when the equipment is found to be faulty or prior to its expiration date.

NOTE: Prior to beginning this procedure, verify that the system cable checkout per SNL Procedure 438, Section III. has been performed.

- I. Installation of Pressure Transducers:
 - A. Following the appropriate equipment operating procedure, vent any pressure that may be on the transducer connection port(s) to ambient atmospheric pressure.
 - B. Record test tool identification number and the gage numbers for transducer ports following the system P&ID on SNL WIPP Form 270. Acquire calibrated pressure transducers for each port where pressure is to be monitored.

- C. Using SNL WIPP Form 34, label 7 columns as "Gage Number", "Serial Number", "Input Resistance", "Output Resistance", "Applied Pressure", "Gage Output", and "Gage Output Engineering Units", write the gage number(s) and serial number(s) in the appropriate columns of the form.
- D. Check and prepare sealing surfaces of the transducers as necessary to make the connection (tape the threads, inspect or replace O-rings, or replace Swagelok fittings).
- E. Install the appropriate transducer(s) to the pressure sensing port(s) following the system P&ID. Record the transducer serial number(s) as a function of gage number(s) on SNL WIPP Form 270. Also record each transducer's type, make, calibration date, calibration due date, and installation date.
- F. Insert and tighten any hardware or set screws used for installing the transducers in place.
- G. Locate the DAS connection cable for each transducer. If possible deactivate or disconnect the gage power supplies. Following the equipment P&ID and Cable Schematic, connect the proper cable to the transducer to be checked. Leave the other cables disconnected.
- H. Using a calibrated ohm-meter measure the resistance across the input transducer leads at the cable terminal strip. Record this value in the "Input Resistance" column of SNL WIPP Form 34.
- I. Measure and record the resistance across the transducer output leads in the "Output Resistance" column of SNL WIPP Form 34.
- J. If additional gages are being installed, disconnect this gage's DAS cable. Repeat steps G. through I. until all desired resistance values are recorded on SNL WIPP Form 34.
- K. When resistance measurements are complete, reconnect all DAS cables to the transducers.
- L. Activate or reconnect the gage power supply if not already activated. An external power supply may be used by application at the gage and excitation cable terminal strip following the Cabling Schematic. Check and adjust (if necessary) the power supply to the desired excitation voltage.

NOTE: For multiple gage installations, steps M. through P. should be performed simultaneously upon similar gage types.

- M. Using either a digital voltmeter with current calibration or a calibrated Fluke Hydra Data Bucket measure the gage output at ambient or atmospheric pressure. Record this value and the corresponding pressure on SNL WIPP Form 34. The voltmeter can be connected at the gage terminal strips. The Fluke can be plugged into its pre-wired connections.
- N. Using the gage calibration summary sheets and a calculator, determine the corresponding engineering units output for the gage. Calculate the engineering units (EU) value, using the voltage reading from step M. and the gage calibration coefficients ($C1$ = slope/scale factor; $C0$ = intercept/offset). Use the $Mx + B$ equation: $EU = C1 \times (\text{output voltage}) + C0$ and record the result in the "Gage Output Engineering Units" column on SNL WIPP Form 34.
- O. Following the fluid flow test system operating procedure and the system P&ID, configure the system so that a controlled pressure may be applied to the transducer. Apply pressure of magnitude equal to approximately 1/2 the transducer full scale range to the transducer. This pressure is to be monitored by, and recorded from, a front panel analog gage or regulator output gage. On the next row of SNL WIPP Form 34, record the gage number, transducer serial number, applied pressure, gage output, and gage output engineering units in the corresponding labelled columns of the form.
- P. Repeat this process for atmospheric or ambient pressure and record the results on the form on the next line.
- Q. Compare the transducer engineering units against the applied pressure as measured by an analog gage of either the front panel or regulator. If these values are within ± 10 percent of each other, the transducer can be assumed to be functioning properly. Indicate proper gage function in the "Acceptance Check" column of SNL WIPP Form 270 by writing "Passed". If these values are not within ± 10 percent, contact the fluid flow system SNL DAS/Gage consultant for further direction.
- R. Load the new gage coefficients for the installed gages per SNL Procedure 485.
- S. De-energize the power supply and perform a system verification per SNL Procedure 438, Section IV.B. through VI.B.
- T. Return completed SNL WIPP Forms 34 and 270 to the SNL DAS/Gage consultant.

II. Replacement of Pressure Transducers

NOTE: All pressure sources should be vented to zero pressure prior to beginning work in removal or replacement.

- A. De-energize excitation voltage to transducers being removed or replaced.
- B. Disconnect cable connector at or near the transducer and if unlabelled, label the connector as to gage number and position for reattachment.
- C. Remove any set screws that may hold transducer to a mounting bracket.
- D. Disconnect the transducer port from the pressure sensing port.
- E. Take precautions to prevent contaminants from entering the plumbing system.
- F. Record the transducer serial number(s) as a function of gage number on SNL WIPP Form 270. Also record each transducer's type, make, calibration date, calibration due date, and removal date. Return the transducer to the SNL WIPP Calibration Lab for post use assessment.
- G. Return completed SNL WIPP Forms 34 and 270 to the SNL DAS/Gage consultant.
- H. Return to Section I. and install/checkout replacement transducer(s). Record the results on new SNL WIPP Forms 34 and 270 (as opposed to the ones used for original installation).

III. Installation of Thermocouples

- A. Record test system identification number and thermocouple gage numbers for temperature measurement locations following the system P&ID on SNL WIPP Form 270. Acquire recently calibrated thermocouples to be placed at locations where temperature is to be monitored.
- B. Check and prepare the mounting bracket as necessary to perform the installation.
- C. Install the thermocouple (TC) at the location where measurements are to be made following the system P&ID. Record the gage serial number(s) as a function of gage number on SNL WIPP Form 270. Also record each thermocouple's type, make, calibration date, calibration due date, and installation date.
- D. Connect the two leads of the thermocouple to a digital voltmeter set on the microvolt scale. Monitor the voltage output from the TC while applying a heat source (heat gun or equivalent) to the sensing unit. If it is increasing with temperature, the TC is connected to the voltmeter with the correct polarity. If not, the polarity is reversed. Using this information, identify the positive and negative leads.

- E. If the polarity check indicates proper function, proceed to the next step. If it does not function properly, proceed to step G.
- F. Connect a calibrated digital ohm-meter to the TC leads and measure the TC resistance. TCs will typically read approximately 2 Ω /foot, so the measured resistance should correspond within 20 percent of this value.
- G. If the TC meets the requirements of steps E. and F., write "Passed" in the "Acceptance Check" column of SNL WIPP Form 270. If not write "Failed" and contact the SNL DAS/Gage consultant.
- H. Locate the DAS connection point to the cable terminal strip for each TC following the equipment P&ID and Cable Schematic. Connect the TC leads to the terminal strip.
- I. Repeat Steps A. through H. above for additional TCs, recording the results on SNL WIPP Form 270 for all TC's.
- J. Return completed SNL WIPP Form 270 to the SNL DAS/Gage consultant.

IV. Replacement of Thermocouples

- A. Remove any fasteners that may hold the TC to the mounting bracket and remove the TC from the temperature sensing location.
- B. Disconnect TC cable from the cable terminal strip. Verify that the original TC label is intact and legible. Label the TC with the tool designation and date of removal. Package and transport it to the SNL WIPP Calibration Lab.
- C. Record the old transducer serial number(s) as a function of gage number on SNL WIPP Form 270. Also record each transducer's type, make, calibration date, calibration due date, and removal date.
- D. Return completed SNL WIPP Form 270 to the SNL DAS/Gage consultant.
- E. Return to Section III. and install/checkout the replacement TC(s). Record the results on a new SNL WIPP Form 270.

V. Installation of the Fluke Hydra Data Bucket

- A. Obtain a recently calibrated Fluke Hydra Data Bucket with an affixed calibration sticker.
- B. Ensure the battery or power feed is shut-off.

- C. On SNL WIPP Form 270 record the test system identification number. In the "Make" column of SNL WIPP Form 270, write "Fluke Hydra" and enter "DAS" in the "Gage Type" column. Record the Fluke Hydra Data Bucket's serial number, calibration date, calibration due date, and installation date.
- D. Attach the Fluke Hydra Data Bucket to the shelf mounting bracket.
- E. Attach the RS232 cable into the back of the Fluke in the 9-pin computer connection port.
- F. Insert the wired edge connector into the edge connector slot of the Fluke Hydra Data Bucket.
- G. Connect the external battery connection cable to the battery connection receptacle located in the back of the data bucket.
- H. Re-attach the Fluke chassis ground terminal to the system/frame ground wire.
- I. If applicable, attach the Channel Zero leads to the Channel Zero receptacles on the front panel using the Channel Zero banana plugs. Ensure the color of the lead ends matches the color of the receptacles.
- J. Energize the Fluke Hydra Data Bucket by plugging in the 110 vac system battery trickle charger feed and turning on the battery disconnect switch. Push the front panel On/Off switch. It is possible to run the Fluke directly on 110 vac by plugging in the 110 vac power cord into the back of the Fluke.
- K. When the front panel On/Off button is pressed to start the Fluke, the instrument will automatically execute an operations self-check. When the check is complete, the unit will provide a display to indicate proper function or a "beep" and error code to indicate a malfunction. If the "beep" does sound, contact the SNL DAS/Gage consultant for the fluid flow test system.
- L. When the unit provides a normal display, record the check by writing "Passed" in the "Acceptance Check" column of SNL WIPP Form 270.
- M. Reload the existing gage setup configuration to the new data bucket per SNL Procedure 485.
- N. De-energize the power supply and perform system verification per SNL Procedure 438, Section IV.B. through VI.B.
- O. Return the completed SNL WIPP Form 270 to the SNL WIPP DAS/Gage consultant.

VI. Fluke Hydra Data Bucket Replacement

- A. De-energize the Fluke Hydra Data Bucket and any gage power supplies that are being monitored by the Fluke.
- B. Disconnect the Fluke chassis ground.
- C. Unplug the gage cable edge connector from the back of the Fluke.
- D. Disconnect the RS232 cable from the back of the Fluke.
- E. If applicable, disconnect the Channel Zero leads from the Fluke front panel.
- F. Disconnect the battery feed cable from the back of the Fluke.
- G. Remove the Fluke from the shelf mounting bracket.
- H. On SNL WIPP Form 270 record the test system identification number. In the "Make" column of SNL WIPP Form 270, write "Fluke Hydra" and enter "DAS" in the "Gage Type" column. Record the Fluke Hydra Data Bucket's serial number, calibration date, calibration due date, and removal date.
- I. Package the instrument and return to the SNL WIPP Site Calibration Lab for post-use calibration.
- J. Return completed SNL WIPP Form 270 to the SNL DAS/Gage consultant.
- K. Install a replacement Fluke Hydra Data Bucket following Section V. above.

VII. Installation Completion and Acceptance Criteria Review

- A. The SNL DAS/Gage consultant for the fluid flow system will technically review the installation data and comments to ensure that the installation meets the stated acceptance criteria specified in the procedure.
- B. Final approval of the data forms by the SNL DAS/Gage consultant indicates that the gages are adequate for their intended use, based on the consultant's experience and expertise.
- C. After approval by the SNL DAS/Gage consultant, all forms (34 and 270) will be submitted to the SNL WIPP Records office for archival.

REVISION SUMMARY

To be completed by procedure's author before final revision is circulated for signatures.

I. Revisions made: Additional and changes for
clarification.

II. Personnel effected:

(Check appropriate ones)

MOC Craftsman

Drilling _____
Shop _____
Mechanical _____
Electrical _____
Gage _____
Cable/TC _____
U/G DAS _____
Geotech _____

SNL JOB AREA

DAS General _____
DAS B49 Trailer _____
DAS Sheds _____
DAS Equip. Cal. & Inv. _____
Thermocouple _____
Cables _____
Drilling _____
Gage Installation _____
Gage Cal. & Removal _____
Plugging & Sealing _____
Brine Transport _____
QA _____
General _____
Principal Investigator _____
Bin Leak Tester _____
Permeability Testing _____

III. Retraining required:

(Circle One)

Read Re-read procedure

Practical demonstration

Other (explain)

Signature of

Procedure's Author William E. Howarth Date 4-6-95